U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-256 601

Hopatcong and Musconetcong Lakes, Morris and Sussex Counties, New Jersey

National Environmental Research Center

Prepared For
Pacific Northwest Environmental Research Lab.

May 1976

243041

PB 256 601

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

G.P.O. 699-440

REPORT

ON

HOPATCONG AND MUSCONETCONG LAKES

MORRIS AND SUSSEX COUNTIES

NEW JERSEY

EPA REGION II

WORKING PAPER NO. 368

WITH THE COOPERATION OF THE

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

AND THE

NEW JERSEY NATIONAL GUARD

MAY 1976

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO. PB256601
4. TITLE AND SUBTITLE Report on Hopatcong and Musconetcong Lakes, Morris and Sussex Counties, New Jersey.		5. REPORT DATE Prepared May 1976
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Anonymous (National Eutrophication Survey Staff)		8. PERFORMING ORGANIZATION REPORT NO. Working Paper No. 368
9. PERFORMING ORGANIZATION NAME AND ADDRESS National Eutrophication Survey U.S. Environmental Protection Agency P.O. Box 15027 Las Vegas, NV 89114		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Office of Research and Development U.S. Environmental Protection Agency 401 M Street, S. W. Washington, DC 20460		13. TYPE OF REPORT AND PERIOD COVERED Final - 1973
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared in cooperation with the U.S. Environmental Protection Agency, Corvallis Environmental Research Laboratory, Eutrophication Survey Branch, Corvallis, OR 97330

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

18. DISTRIBUTION STATEMENT Release unlimited	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES 51
	20. SECURITY CLASS *(This page)*	22. PRICE 4.50

EPA Form 2220-1 (9-73)

PRICES SUBJECT TO CHANGE

CONTENTS

	Page
Foreword	ii
List of Study Lakes - State of New Jersey	iv
Lake and Drainage Area Maps	v, vi
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	5
III. Lake Water Quality Summary	7
IV. Nutrient Loadings	13
V. Literature Reviewed	19
VI. Appendices	20

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the New Jersey Department of Environmental Protection for professional involvement and to the New Jersey National Guard for conducting the tributary sampling phase of the Survey.

Douglas Clark, Chief of the Bureau of Water Quality Planning and Management, Mr. Frank Takacs, New Jersey National Eutrophication Survey Coordinator, Principal Environmental Specialist, and Robert Kotch, Senior Environmental Engineer, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

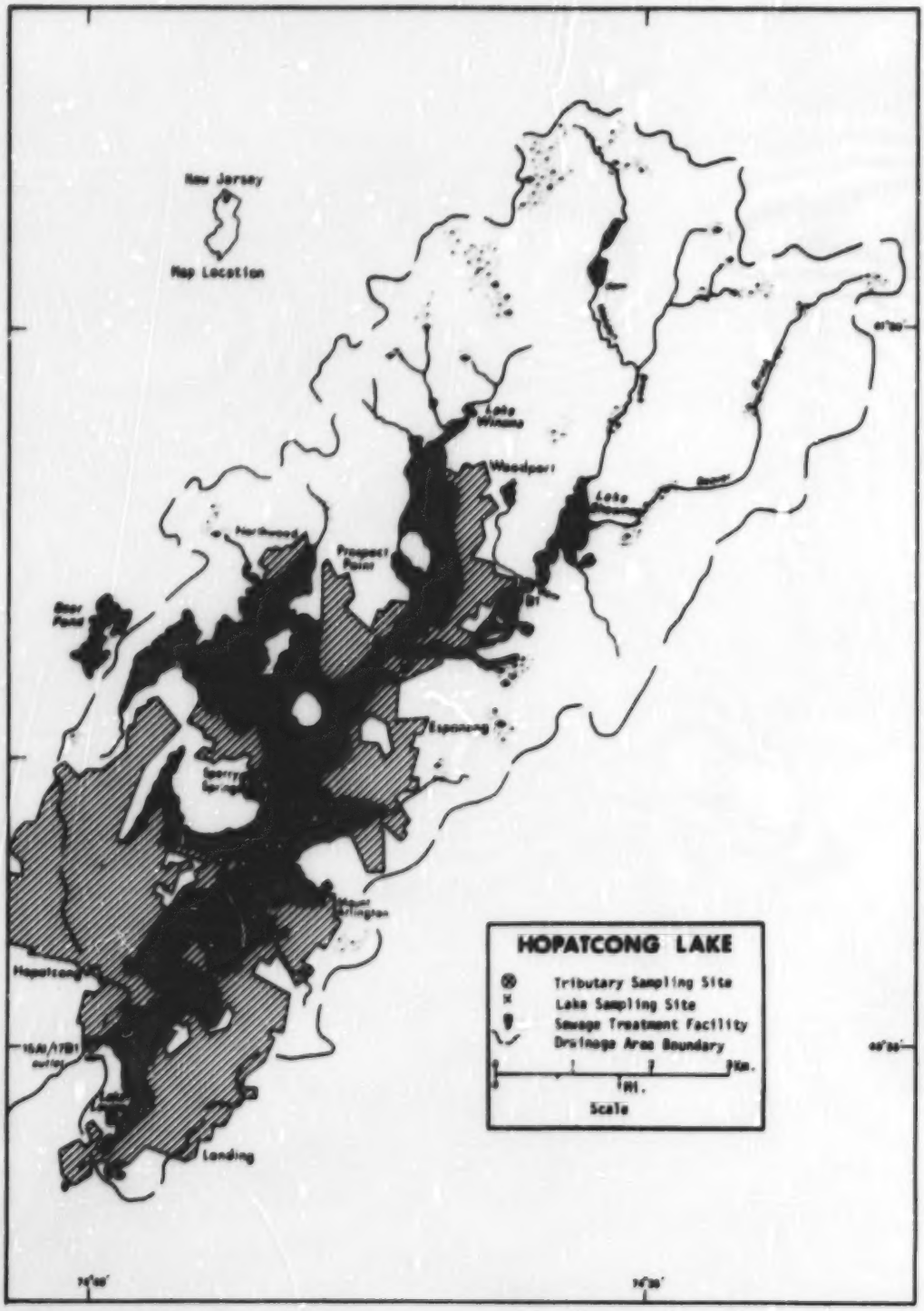
Major General William R. Sharp, Former Chief of Staff, Major General Wilfred G. Menard, Jr., Chief of Staff, and Project Officer Colonel Herbert D. Ruhlin, who directed the volunteer efforts of the New Jersey National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

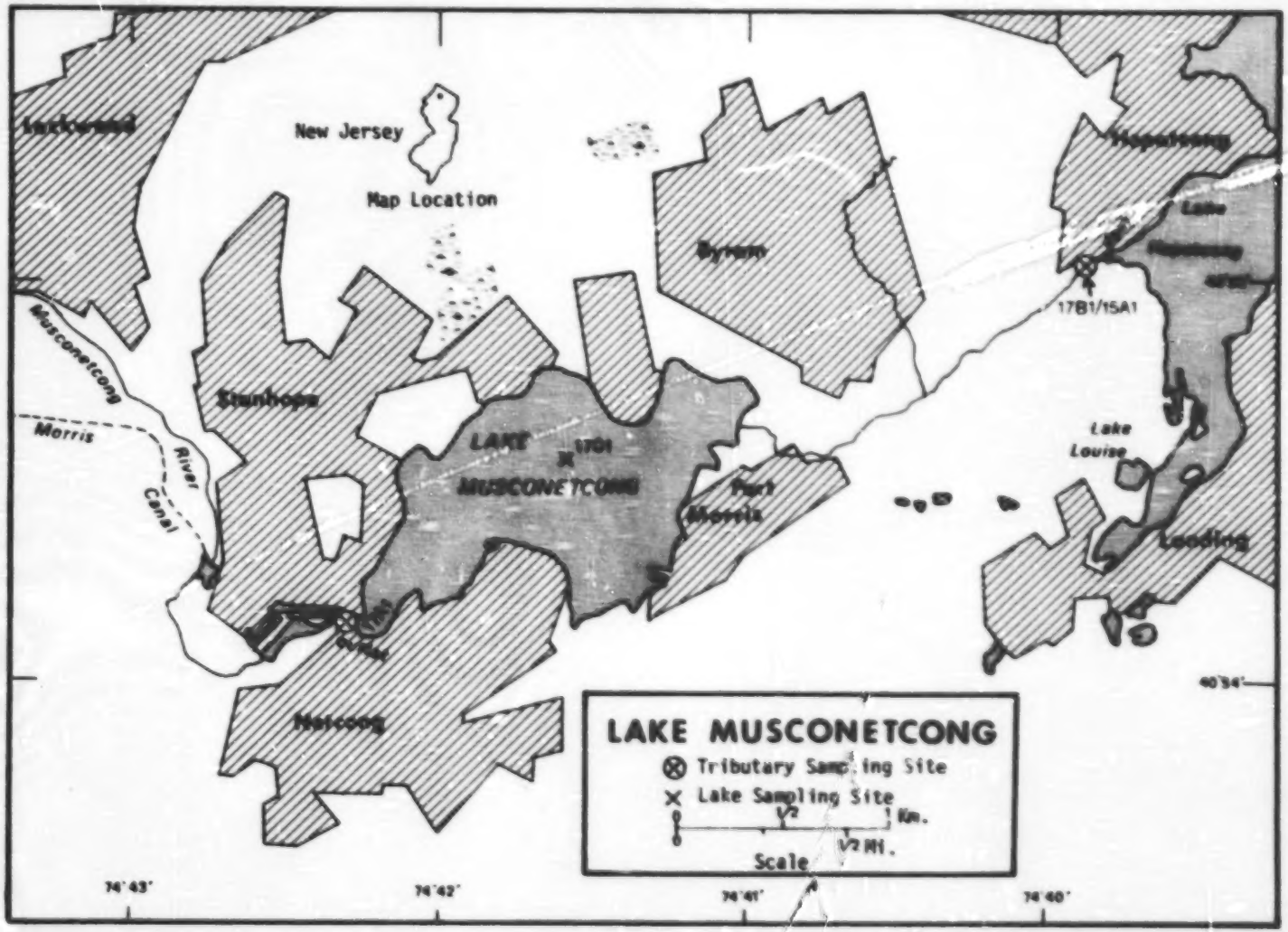
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF NEW JERSEY

LAKE NAME	COUNTY
Budd Lake	Morris
Duhernal Lake	Middlesex
Farrington Lake	Middlesex
Greenwood Lake	Passaic, N.J.; Orange, N.Y.
Lake Hopatcong	Morris, Sussex
Lake Musconetcong	Morris, Sussex
Oradell Reservoir	Bergen
Paulinskill Lake	Sussex
Pinecliff Lake	Passaic
Pompton Lakes	Passaic
Spruce Run Reservoir	Hunterdon
Union Lake	Cumberland
Wanaque Reservoir	Passaic


New Jersey
Map Location
Lake Winona
Woodport
Northwood
Prospect Point
Bear Point
Espanong
Mount Arlington
Hopatcong
Landing
HOPATCONG LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Drainage Area Boundary
Mi.
Scale


New Jersey
Map Location
Byram
Stanhope
Musconetcong
Morris
River
Canal
LAKE
MUSCONETCONG
1701
Port
Morris
Netcong
Lake
Louise
Landing
17B1/15A1
LAKE MUSCONETCONG
Tributary Sampling Site
Lake Sampling Site
Km.
Mi.
Scale
74°43'
74°42'
74°41'
74°40'
40°34'

HOPATCONG AND MUSCONETCONG LAKES, NEW JERSEY

STORET NOS. 3415 AND 3417

I. CONCLUSIONS

A. Trophic Condition:

Lakes Hopatcong and Musconetcong are classified as eutrophic on the basis of Survey data and field observations. Hopatcong Lake is characterized by moderate to low primary production as measured by algal assay control yields, and low nutrient levels and Secchi disc visibility. Oxygen depletion occurred below 4.6 meters in the summer and below 7.6 meters in the fall. Chlorophyll a values ranged from a low of 5.5 µg/l in the fall to a high of 27.7 µg/l in the spring. Survey limnologists reported bottom hydrogen sulfide formation during fall sampling.

Musconetcong Lake is characterized by heavy growth of submerged and emergent vegetation. Secchi disc visibility and potential for primary production were low. Chlorophyll a values ranged from a low of 3.7 µg/l in the fall to a high of 20.1 µg/l in the summer.

In the past, partial annual chemical aquatic weed control programs have been applied to Hopatcong and Musconetcong Lakes. Ketelle and Uttormark (1971) have recommended dredging for both lakes for more permanent aquatic weed control and partial diking of the existing Musconetcong Lake basin to provide spoil areas.

B. Rate-Limiting Nutrient:

Assay results indicate that Musconetcong was limited by available phosphorus levels at the time of sample collection. Spikes with phosphorus, and nitrogen and phosphorus simultaneously resulted in increases in assay yield. The addition of nitrogen alone did not stimulate a growth response. The ratios of mean total inorganic nitrogen to mean orthophosphorus (N/P) in sampled waters indicate phosphorus limitation during spring and autumn.

Assay results for Hopatcong Lake are not considered reliable because of a significant change in the nutrient levels between the time the sample was collected and the assay was begun. The N/P ratios in the lake data suggest phosphorus limitation during spring and summer.

C. Nutrient Controllability:

1. Point Sources -

During the sampling year, the mean annual phosphorus load from municipal point sources was estimated to be 26.7% of the total load reaching Hopatcong Lake. The

Mt. Arlington Garden Apartments contributed 14.3% of this load. There were no known industrial or municipal point sources directly impacting Musconetcong Lake during the sampling year.

It is known that municipal sewage from the Stanleck School impacts Shawnee Lake directly above Hopatcong Lake. However, annual nutrient export values (page 18) for Station B(1) (Unnamed Stream) below Shawnee Dam do not reflect this impact, probably due to the nutrient sink function of Shawnee Lake. Thus, although loading from the Stanleck School may eventually reach Hopatcong Lake, the main impact is to upstream Shawnee. Therefore, estimated loadings for the school are not included in this report.

The present loading of 0.12 g $P/m^2/yr$ (Hopatcong) is below that proposed by Vollenweider (Vollenweider and Dillon, 1974) as "permissible" (oligotrophic) for a lake of such volume and detention time. The loading value of 0.61 g $P/m^2/yr$ (Musconetcong) is below Vollenweider's "dangerous" (eutrophic) level but above the "permissible" levels. Total elimination of the known point sources impacting Hopatcong Lake would further improve water quality in both lakes.

2. Nonpoint Sources -

The mean annual phosphorus load from nonpoint sources was 73.3% of the total impacting Hopatcong Lake, and all of the load directly reaching Musconetcong Lake. Septic tanks were estimated to have contributed 24.8% of the load to Hopatcong Lake. Ungaged tributaries contributed 26.0% and 9.8% of the phosphorus load to each lake, respectively.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. The lake surface area and mean depth were provided by the State of New Jersey. Tributary flow data were provided by the New Jersey District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by the mean flow of the outlet. Precipitation values were estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

		Hopatcong	Musconetcong	
1.	Surface area:	10.87	1.33	km^2.
2.	Mean depth:	5.5	1.5	meters.
3.	Maximum depth:	17.7	3.0	meters.
4.	Volume:	59.785	1.995	$\times 10^6$ m^3.
5.	Mean hydraulic retention time:	623	19	days.

B. Tributary and Outlet (see Appendix B for flow data):

1. Tributaries -

Hopatcong			Musconetcong		
Name	Drainage area(km^2)	Mean flow (m^3/sec)	Name	Drainage area(km^2)	Mean flow (m^3/sec)
B(1) Unnamed Stream	21.0	0.27	B(1) Musconetcong River	66.3	1.11
Minor tributaries and immediate drainage	34.4	0.58	Minor tributaries and immediate drainage	9.3	0.14
Totals	55.4	0.85	Totals	75.6	1.25
2. Outlet -					
A(1) Musconetcong River	66.3	1.11	A(1) Musconetcong River	76.9	1.22

C. Precipitation (both lakes):

1. Year of sampling - 154.1 cm.

2. Mean annual - 120.6 cm.

III. LAKE WATER QUALITY SUMMARY

Hopatcong and Musconetcong Lakes were sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from five stations on Hopatcong Lake and one station on Musconetcong Lake and from a number of depths at each station (see maps, pages v and vi). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first visit, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 2.1 meters at Station 1, 12.5 meters at Station 2, 13.4 meters at Station 3, 9.1 meters at Station 4, and 4.0 meters at Station 5 on Hopatcong Lake; and 0.9 meters at Station 1 on Musconetcong Lake. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III B. Results of the limiting nutrient study are presented in III C.

LAKE HOPATCONG
STORET CODE 3415

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(4/17/73) S*** = 5 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(7/23/73) S*** = 5 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(10/ 3/73) S*** = 5 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	9.9- 12.7	10.7	0.0- 1.5	9	25.1- 26.2	25.4	0.0- 1.5	10	18.0- 19.5	19.0	0.0- 1.5
MAX DEPTH**	5	8.5- 11.1	9.1	1.5- 13.4	5	13.0- 25.3	13.9	2.1- 13.1	5	12.0- 19.0	18.7	1.5- 12.8
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	1	11.9- 11.9	11.9	1.5- 1.5	5	7.2- 8.4	7.8	0.0- 1.5	5	8.0- 8.4	8.3	1.5- 1.5
MAX DEPTH**	4	11.3- 11.9	11.6	1.5- 13.4	5	0.1- 6.8	1.0	2.1- 13.1	4	0.2- 8.0	6.3	1.5- 12.2
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	148.- 165.	160.	0.0- 1.5	9	136.- 165.	161.	0.0- 1.5	10	153.- 175.	173.	0.0- 1.5
MAX DEPTH**	5	140.- 170.	162.	1.5- 13.4	5	134.- 166.	137.	2.1- 13.1	5	174.- 186.	179.	1.5- 12.8
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	6	6.9- 7.9	7.8	0.0- 1.5	6	6.9- 7.5	7.2	0.0- 1.5	10	6.5- 7.1	6.8	0.0- 1.5
MAX DEPTH**	5	7.8- 7.9	7.8	1.5- 13.4	5	6.5- 6.8	6.6	2.1- 13.1	5	6.5- 6.8	6.6	1.5- 12.8
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	6	12.- 19.	17.	0.0- 1.5	6	21.- 25.	24.	0.0- 1.5	10	21.- 36.	30.	0.0- 1.5
MAX DEPTH**	5	13.- 20.	17.	1.5- 13.4	5	24.- 37.	28.	2.1- 13.1	5	23.- 45.	30.	1.5- 12.8
TOTAL P (MG/L)												
0.-1.5 M DEPTH	6	0.013-0.023	0.017	0.0- 1.5	6	0.019-0.030	0.022	0.0- 1.5	10	0.019-0.033	0.023	0.0- 1.5
MAX DEPTH**	5	0.013-0.026	0.018	1.5- 13.4	5	0.020-0.156	0.035	2.1- 13.1	5	0.022-0.199	0.068	1.5- 12.8
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	6	0.004-0.006	0.005	0.0- 1.5	6	0.005-0.011	0.007	0.0- 1.5	10	0.004-0.011	0.007	0.0- 1.5
MAX DEPTH**	5	0.005-0.006	0.005	1.5- 13.4	5	0.007-0.037	0.030	2.1- 13.1	5	0.006-0.121	0.008	1.5- 12.8
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	6	0.060-0.120	0.095	0.0- 1.5	6	0.040-0.060	0.055	0.0- 1.5	10	0.020-0.030	0.020	0.0- 1.5
MAX DEPTH**	5	0.080-0.120	0.090	1.5- 13.4	5	0.040-0.060	0.040	2.1- 13.1	5	0.020-0.030	0.020	1.5- 12.8
AMMONIA (MG/L)												
0.-1.5 M DEPTH	6	0.030-0.040	0.040	0.0- 1.5	6	0.060-0.090	0.075	0.0- 1.5	10	0.030-0.060	0.040	0.0- 1.5
MAX DEPTH**	5	0.040-0.050	0.040	1.5- 13.4	5	0.070-0.500	0.390	2.1- 13.1	5	0.060-1.210	0.090	1.5- 12.8
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	6	0.300-0.800	0.350	0.0- 1.5	6	0.500-1.000	0.650	0.0- 1.5	10	0.400-0.800	0.600	0.0- 1.5
MAX DEPTH**	5	0.200-0.400	0.300	1.5- 13.4	5	9.500-1.100	0.800	2.1- 13.1	5	0.600-1.600	0.800	1.5- 12.8
SECCHI DISC (METERS)	5	1.5- 1.8	1.8		5	1.0- 2.7	2.4		5	1.9- 2.7	2.3	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

LAKE MUSCONETCONG
STORET CODE 3417

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(4/17/73) S*** = 1 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(7/23/73) S*** = 1 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(10/ 1/73) S*** = 1 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	1	13.5- 13.5	13.5	0.0- 0.0	2	26.6- 27.3	26.9	0.0- 0.9	1	19.3- 19.3	19.3	0.0- 0.0
MAX DEPTH**	1	13.5- 13.5	13.5	0.0- 0.0	1	26.6- 26.6	26.6	0.9- 0.9	1	19.3- 19.3	19.3	0.0- 0.0
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	1	10.0- 10.0	10.0	0.0- 0.0	1	9.0- 9.0	9.0	0.9- 0.9	1	9.0- 9.0	9.0	0.0- 0.0
MAX DEPTH**	1	10.0- 10.0	10.0	0.0- 0.0	1	9.0- 9.0	9.0	0.9- 0.9	1	9.0- 9.0	9.0	0.0- 0.0
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	1	195.- 195.	195.	0.0- 0.0	2	195.- 196.	196.	0.0- 0.9	1	350.- 350.	350.	0.0- 0.0
MAX DEPTH**	1	195.- 195.	195.	0.0- 0.0	1	195.- 195.	195.	0.9- 0.9	1	350.- 350.	350.	0.0- 0.0
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	1	7.9- 7.9	7.9	0.0- 0.0	2	7.6- 8.5	8.0	0.0- 0.9	1	6.9- 6.9	6.9	0.0- 0.0
MAX DEPTH**	1	7.9- 7.9	7.9	0.0- 0.0	1	7.6- 7.6	7.6	0.9- 0.9	1	6.9- 6.9	6.9	0.0- 0.0
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	1	28.- 28.	28.	0.0- 0.0	2	33.- [illegible]	34.	0.0- 0.9	1	13.- 13.	13.	0.0- 0.0
MAX DEPTH**	1	28.- 28.	28.	0.0- 0.0	1	33.- 33.	33.	0.9- 0.9	1	13.- 13.	13.	0.0- 0.0
TOTAL P (MG/L)												
0.-1.5 M DEPTH	1	0.027-0.027	0.027	0.0- 0.0	2	0.044-0.118	0.081	0.0- 0.9	1	0.020-0.020	0.020	0.0- 0.0
MAX DEPTH**	1	0.027-0.027	0.027	0.0- 0.0	1	0.118-0.118	0.118	0.9- 0.9	1	0.020-0.020	0.020	0.0- 0.0
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	1	0.012-0.012	0.012	0.0- 0.0	2	0.009-0.035	0.022	0.0- 0.9	1	0.006-0.006	0.006	0.0- 0.0
MAX DEPTH**	1	0.012-0.012	0.012	0.0- 0.0	1	0.035-0.035	0.035	0.9- 0.9	1	0.006-0.006	0.006	0.0- 0.0
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	1	0.150-0.150	0.150	0.0- 0.0	2	0.050-0.060	0.055	0.0- 0.9	1	0.030-0.030	0.030	0.0- 0.0
MAX DEPTH**	1	0.150-0.150	0.150	0.0- 0.0	1	0.060-0.060	0.060	0.9- 0.9	1	0.030-0.030	0.030	0.0- 0.0
AMMONIA (MG/L)												
0.-1.5 M DEPTH	1	0.050-0.050	0.050	0.0- 0.0	2	0.070-0.100	0.085	0.0- 0.9	1	0.060-0.060	0.060	0.0- 0.0
MAX DEPTH**	1	0.050-0.050	0.050	0.0- 0.0	1	0.100-0.100	0.100	0.9- 0.9	1	0.060-0.060	0.060	0.0- 0.0
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	1	0.600-0.600	0.600	0.0- 0.0	2	0.800-1.200	1.000	0.0- 0.9	1	0.800-0.800	0.800	0.0- 0.0
MAX DEPTH**	1	0.600-0.600	0.600	0.0- 0.0	1	1.200-1.200	1.200	0.9- 0.9	1	0.800-0.800	0.800	0.0- 0.0
SECCHI DISC (METERS)												
	1	1.5- 1.5	1.5		1	1.0- 1.0	1.0		1	1.5- 1.5	1.5	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Hopatcong

Sampling Date	Dominant Genera	Algal Units per ml
04/17/73	1. Tabellaria	17,638
	2. Asterionella	8,435
	3. Synedra	4,175
	4. Cyclotella	3,579
	5. Fragilaria	3,067
	Other genera	5,795
	Total	42,689
07/23/73	1. Flagellates	1,135
	2. Tabellaria	1,054
	3. Fragilaria	730
	4. Dinobryon	297
	5. Asterionella	135
	Other genera	378
	Total	3,729
10/03/73	1. Melosira	1,240
	2. Flagellates	717
	3. Dinobryon	401
	4. Stephanodiscus	384
	5. Kirchneriella	245
	Other genera	1,030
	Total	4,017

Musconetcong

Sampling Date	Dominant Genera	Algal Units per ml
	(Data not available)	
07/23/74	1. Flagellates	3,190
	2. Mougeotia	264
	3. Fragilaria	220
	4. Oocystis	154
	5. Ankistrodesmus	88
	Other genera	484
	Total	4,400
10/01/73	1. Flagellates	580
	2. Kirchneriella	224
	3. Scenedesmus	83
	4. Microcystis	24
	5. Crucigenia	17
	Other genera	59
	Total	987

2. Chlorophyll a -

Hopatcong			Musconetcong		
Sampling Date	Station Number	Chlorophyll a (µg/liter)	Sampling Date	Station Number	Chlorophyll a (µg/liter)
04/17/73	1	21.4	04/17/73	1	9.4
	2	26.2			
	3	27.7			
	4	26.1			
	5	12.6			
07/23/73	1	11.4	07/23/73	1	20.1
	2	9.3			
	3	7.1			
	4	9.2			
	5	13.2			
10/03/73	1	6.2	10/01/73	1	3.7
	2	5.5			
	3	7.5			
	4	7.8			
	5	13.2			

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

	Hopatcong			Musconetcong		
Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum yield (mg/l-dry wt.)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum yield (mg/l-dry wt.)
Control				0.010	0.178	0.2
0.05 P		(See Discussion, page 12)		0.060	0.178	5.1
0.05 P + 1.0 N				0.060	1.178	18.2
1.00 N				0.010	1.178	0.9

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary production in Musconetcong Lake was low at the time of sampling. In the assay, the increase in yield with the addition of phosphorus as well as the lack of increase when only nitrogen was added indicates phosphorus limitation. Maximum growth potential was achieved with the simultaneous addition of both phosphorus and nitrogen.

The N/P ratios in Lake Musconetcong were 12/1 and 15/1 in the spring and fall, respectively, indicating phosphorus limitation, and 7/1 during summer sampling suggesting nitrogen limitation at that time.

The algal assay results for Lake Hopatcong are not considered reliable because of a significant change in the nutrient levels between the time the sample was collected and the assay was begun. However, N/P ratios in lake chemistry data suggest phosphorus limitation in spring and summer, with ratios of 22/1 and 16/1, respectively, and nitrogen limitation during the fall with a ratio of 10/1.

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the New Jersey National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the maps (pages v and vi), except for the high runoff month of February when two samples were collected. Sampling was begun in July 1973, and was completed in April 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the New Jersey District Office of USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for the unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) in both lakes were estimated by using the mean annual concentrations in Unnamed Stream at Station B(1) (Hopatcong Lake) and mean annual ZZ flow.

The operators of the Our Lady of the Lake School and Mt. Arlington Garden Apartments (Mt. Arlington) wastewater treatment plants provided monthly effluent samples and corresponding flow data. Nutrient loads for the Consolidated School were estimated at 0.567 kg P and 1.701 kg N/capita/ 180-day school year.

A. Waste Sources (Lake Hopatcong only):

1. Known municipal -

Name	Population Served*	Treatment*	Mean Flow ($m^3/d \times 10^3$)	Receiving Water*
Mt. Arlington Garden Apts. (Mt. Arlington)	450	Activated Sludge	0.085	Lake Hopatcong
Our Lady of the Lake School	250	Activated Sludge	0.004	Lake Hopatcong
Consolidated School**	275	Extended Aeration	0.104***	Unnamed Stream

*Treatment plant questionnaires.
**Lundin, personal communication.
***Estimated at 0.3785 m^3/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Hopatcong Lake

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
B(1) Unnamed Stream	140	10.9
b. Minor tributaries and immediate drainage (nonpoint load) -	295	22.9
c. Known Municipal STP's -		
Mt. Arlington Garden Apts.	185	14.3
Our Lady of the Lake School	5	0.4
Consolidated School	155	12.0
d. Septic tanks* -	320	24.8
e. Known industrial - None		
f. Direct precipitation** -	190	14.7
Totals	1,290	100.0

Musconetcong Lake

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
B(1) Musconetcong River	710	87.7
b. Minor tributaries and immediate drainage (nonpoint load) -	70	8.6
c. Known Municipal STP's - None		
d. Septic tanks* -	5	0.6
e. Known industrial - None		
f. Direct precipitation** -	25	3.1
Totals	810	100.0

2. Output - A(1) Musconetcong River	710	A(1) Musconetcong River 1,030
3. Net annual P accumulation -	580	Net annual P export*** - 220

*Estimate for Hopatcong based on 1,088 lakeside residences and 11 park tanks.
Estimate for Musconetcong based on 12 lakeside residences.
**Estimated (see NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Hopatcong Lake

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
B(1) Unnamed Stream	9,295	17.2
b. Minor tributaries and immediate drainage (nonpoint load) -	19,845	36.7
c. Known Municipal STP's -		
Mt. Arlington Garden Apts.	550	1.0
Our Lady of the Lake School	50	0.1
Consolidated School	470	1.0
d. Septic tanks* -	11,980	22.2
e. Known industrial - None		
f. Direct precipitation** -	11,735	21.8
Totals	53,925	100.0
2. Output - A(1) Musconetcong River	31,370	
3. Net annual N accumulation -	22,555	

Musconetcong Lake

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
B(1) Musconetcong River	31,370	83.2
b. Minor tributaries and immediate drainage (nonpoint load) -	4,790	12.7
c. Known Municipal STP's - None		
d. Septic tanks* -	130	0.3
e. Known industrial - None		
f. Direct precipitation** -	1,435	3.8
Totals	37,725	100.0
A(1) Musconetcong River	30,030	
Net annual N accumulation -	7,695	

*Estimate for Hopatcong based on 1,088 lakeside residences and 11 park tanks.
Estimate for Musconetcong based on 12 lakeside residences.
**Estimated (see NES Working Paper No. 175).

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Hopatcong Lake - B(1) Unnamed Stream	7	443
Musconetcong Lake - B(1) Musconetcong River	11	473

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Yearly Phosphorus Loading (g/m²/yr)	
	Hopatcong	Musconetcong
Estimated loading	0.12	0.61
Vollenweider's "dangerous" or eutrophic loading	0.35	1.04
Vollenweider's "permissible" or oligotrophic loading	0.17	0.52

V. LITERATURE REVIEWED

Ketelle, M. J. and P. D. Uttormark. 1971. Problem Lakes in the United States. U.S. Environmental Protection Agency Project #16010 EHR. University of Wisconsin, Madison, Wisconsin.

Lundin, Clifford R. 1976. Personal communication, Office of Environmental Commission, Borough of Hopatcong, New Jersey.

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. Environmental Monitoring and Support Laboratory, Las Vegas, Nevada, and Corvallis Environmental Research Laboratory, Corvallis, Oregon.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR NEW JERSEY 06/04/76

LAKE CODE 3415 LAKE HOPATCONG

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 66.3

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
3415A1	66.3	1.44	1.42	0.85	1.13	0.88	0.65	0.40	0.74	1.00	1.33	1.67	1.76	1.11
3415B1	21.0	0.31	0.34	0.57	0.54	0.31	0.16	0.11	0.12	0.11	0.11	0.25	0.31	0.27
3415Z2	45.3	0.68	0.74	1.22	1.16	0.68	0.34	0.24	0.26	0.23	0.23	0.54	0.68	0.58

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 66.3 TOTAL FLOW IN = 10.22
SUM OF SUB-DRAINAGE AREAS = 66.3 TOTAL FLOW OUT = 13.34

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
3415A1	7	73	1.359	21	0.850				
	8	73	0.765	18	0.651				
	9	73	0.850	22	0.736				
	10	73	0.368	27	0.147				
	11	73	2.747	18	2.917				
	12	73	3.171	8	2.549				
	1	74	3.653	5	5.352				
	2	74	1.671	2	1.982	24	1.048		
	3	74	0.368	31	0.893				
	4	74	1.841	28	1.169				
	5	74	1.416						
	6	74	0.991						
3415B1	7	73	0.340	21	1.218				
	8	73	0.138	18	0.085				
	9	73	0.057	22	0.051				
	10	73	0.113	27	0.027				
	11	73	0.159	18	0.125				
	12	73	1.133	8	0.340				
	1	74	0.708	5	0.765				
	2	74	0.453	2	0.623	24	0.736		
	3	74	0.566	31	1.586				
	4	74	0.934	28	0.340				
	5	74	0.453						
	6	74	0.246						
3415Z2	7	73	0.736	21	2.633				
	8	73	0.280	18	0.184				
	9	73	0.122	22	0.110				
	10	73	0.244	27	0.057				
	11	73	0.340	18	0.269				
	12	73	2.438	8	0.736				
	1	74	1.529	5	1.642				
	2	74	0.991	2	1.359	24	1.586		
	3	74	1.218	31	3.626				
	4	74	2.010	28	0.736				
	5	74	0.991						
	6	74	0.530						

TRIBUTARY FLOW INFORMATION FOR NEW JERSEY 06/04/76

LAKE CODE 3417 LAKE HUSCONETCONG

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 76.9

NORMALIZED FLOWS(CMS)

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
341741	76.9	1.99	1.56	1.13	1.42	1.62	0.65	0.37	0.74	1.10	1.42	1.81	1.98	1.22
341781	64.3	1.44	1.42	0.85	1.13	0.88	0.65	0.48	0.74	1.08	1.33	1.67	1.76	1.11
341722	10.6	0.159	0.173	0.283	0.272	0.159	0.079	0.057	0.059	0.054	0.054	0.130	0.159	0.136

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 76.9
SUM OF SUB-DRAINAGE AREAS = 76.9

TOTAL FLOW IN = 14.97
TOTAL FLOW OUT = 14.78

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
341741	7	73	1.444	21	1.444				
	8	73	0.765	18	0.651				
	9	73	0.850	22	0.736				
	10	73	0.396	27	0.159				
	11	73	3.143	10	3.370				
	12	73	3.653	8	2.917				
	1	74	4.191	5	6.088				
	2	74	1.812	2	2.294	24	1.416		
	3	74	0.651	31	0.906				
	4	74	2.322	28	1.359				
	5	74	1.642						
	6	74	1.076						
341781	7	73	1.359	21	0.850				
	8	73	0.765	18	0.651				
	9	73	0.850	22	0.736				
	10	73	0.368	27	0.147				
	11	73	2.747	10	2.917				
	12	73	3.171	8	2.549				
	1	74	3.653	5	5.352				
	2	74	1.671	2	1.982	24	1.048		
	3	74	0.368	31	0.693				
	4	74	1.041	28	1.189				
	5	74	1.416						
	6	74	0.991						
341722	7	73	0.173	21	0.595				
	8	73	0.065	18	0.042				
	9	73	0.028	22	0.025				
	10	73	0.057	27	0.014				
	11	73	0.079	10	0.062				
	12	73	0.566	8	0.173				
	1	74	0.368	5	0.396				
	2	74	0.229	2	0.311	24	0.368		
	3	74	0.283	31	0.793				
	4	74	0.481	28	0.173				
	5	74	0.229						
	6	74	0.127						

27

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 76/06/04

341501
40 55 10.0 074 39 10.0 3
LAKE HOPATCONG
34037 NEW JERSEY

020392

11EPALES 2111202
0009 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	11 10	0000	10.7		72	160	7.80	19	0.030	0.400	0.100	0.006
	11 10	0005	10.3	11.9		165	7.80	18	0.040	0.300	0.090	0.006
73/07/23	09 50	0000	25.1	7.8	72	165	6.90	23	0.090	0.900	0.060	0.008
	09 50	0007	25.0	6.4		166	6.80	24	0.100	0.600	0.060	0.007
73/10/03	12 00	0000	19.2		108	173	7.10	30	0.040	0.800	0.030	0.011
	12 00	0005	19.0	8.0		174	6.80	30	0.060	0.600	0.020	0.008

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	11 10	0000	0.019	21.4
	11 10	0005	0.018	
73/07/23	09 50	0000	0.030	11.4
	09 50	0007	0.028	
73/10/03	12 00	0000	0.019	6.2
	12 00	0005	0.022	

STORET RETRIEVAL DATE 76/06/04

341502
40 56 17.0 074 38 40.0 3
LAKE HOPATCONG
34037 NEW JERSEY

020302

11EPALES 2111202
0045 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-ORS ORTHO MG/L P
73/04/17	11 30	0000	9.9		60	155	7.90	17	0.040	0.600	0.100	0.005
	11 30	0006	9.5	12.2		170	7.90	18	0.040	0.400	0.090	0.007
	11 30	0015	9.1	12.0		165	7.90	17	0.030	0.400	0.080	0.005
	11 30	0022	9.0	11.9		160	7.90	18	0.030	0.300	0.090	0.005
	11 30	0031	8.9	11.9		145	7.90	17	0.030	0.300	0.080	0.005
	11 30	0041	8.9	11.6		145	7.80	17	0.040	0.300	0.090	0.005
73/07/23	10 20	0000	25.4	8.2	96	164	7.30	22	0.060	0.600	0.040	0.005
	10 20	0005	25.4			163						
	10 20	0010	25.3			161						
	10 20	0015	25.1	7.6		164	7.10	22	0.050	0.400	0.040	0.004
	10 20	0020	22.3	1.0		147	6.50	23	0.100	0.500	0.090	0.011
	10 20	0025	15.9			129						
	10 20	0030	14.5			128						
	10 20	0035	13.6			130						
	10 20	0040	13.0	0.1		135	6.60	33	0.500	0.800	0.040	0.037
73/10/03	11 35	0000	19.5		96	173	6.80	30	0.040	0.600	0.020	0.011
	11 35	0005	19.0	8.4		171	6.60	31	0.040	0.500	0.020	0.009
	11 35	0020	18.7	7.2		171	6.60	32	0.060	0.500	0.020	0.008
	11 35	0030	16.2	0.4		174	6.40	41	0.400	0.800	0.020	0.017
	11 35	0040	13.2	0.2		179	6.50	43	0.080	1.400	0.020	0.121

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	11 30	0000	0.017	26.2
	11 30	0006	0.013	
	11 30	0015	0.014	
	11 30	0022	0.013	
	11 30	0031	0.021	
	11 30	0041	0.026	
73/07/23	10 20	0000	0.019	9.3
	10 20	0015	0.035	
	10 20	0020	0.026	
	10 20	0040	0.045	
73/10/03	11 35	0000	0.023	5.5
	11 35	0005	0.024	
	11 35	0020	0.022	
	11 35	0030	0.051	
	11 35	0040	0.139	

37

STORET RETRIEVAL DATE 76/06/04

341503
40 56 44.0 074 37 50.0 3
LAKE HOPATCONG
34027 NEW JERSEY
020392

11EPALES 2111202
0040 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	14 10	0000	11.2		72	160	7.90	16	0.040	0.080	0.060	0.006
	14 10	0006	10.4	12.1		162	8.00	18	0.030	0.700	0.060	0.006
	14 10	0015	9.7	11.9		160	8.00	21	0.030	0.500	0.070	0.008
	14 10	0022	9.4	11.8		160	8.00	17	0.030	0.600	0.080	0.009
	14 10	0033	9.2	11.7		155	7.90	17	0.040	0.600	0.080	0.004
	14 10	0044	9.1	11.6		162	7.90	20	0.040	0.400	0.090	0.005
73/07/23	11 05	0000	25.5	7.4	100	161	7.20	24	0.080	0.700	0.050	0.006
	11 05	0005	25.4			159						
	11 05	0010	25.3			159						
	11 05	0015	24.5	6.8		150	6.90	25	0.080	0.500	0.050	0.010
	11 05	0020	20.3	0.8		141	6.40	25	0.090	0.300	0.050	0.000
	11 05	0025	15.3			130						
	11 05	0030	14.2	0.2		129	6.50	30	0.200	0.300	0.040	0.010
	11 05	0035	13.8			130						
	11 05	0040	13.3			133						
	11 05	0043	13.2	1.0		134	6.60	37	0.400	0.000	0.040	0.032
73/10/03	11 05	0000	19.1		84	173	6.00	29	0.040	0.600	0.030	0.004
	11 05	0005	19.1	8.4		172	6.00	28	0.030	0.500	0.030	0.007
	11 05	0015	18.9	8.2		170	6.00	30	0.030	0.500	0.020	0.012
	11 05	0025	18.4	5.8		169	6.40	31	0.090	0.600	0.020	0.007
	11 05	0035	14.1	0.1		174	6.60	41	0.610	0.800	0.020	0.060
	11 05	0042	12.8			186	6.50	45	1.210	1.600	0.030	0.101

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	14 10	0000	0.023	27.7
	14 10	0006	0.019	
	14 10	0015	0.030	
	14 10	0022	0.019	
	14 10	0033	0.018	
	14 10	0044	0.018	
73/07/23	11 05	0000	0.019	7.1
	11 05	0015	0.020	
	11 05	0020	0.020	
	11 05	0030	0.019	
	11 05	0043	0.035	
73/10/03	11 05	0000	0.021	7.5
	11 05	0005	0.027	
	11 05	0015	0.025	
	11 05	0025	0.027	
	11 05	0035	0.082	
	11 05	0042	0.199	

STORET RETRIEVAL DATE 76/06/04

341504
40 57 42.0 074 39 00.0 3
LAKE HOPATCONG
34037 NEW JERSEY
020392

11EPALES 2111202
0030 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT K-JEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	14 30	0000	10.8		72	165	7.90	16	0.040	0.300	0.060	0.004
	14 30	0006	10.3	12.3		170	8.00	14	0.030	0.200K	0.050	0.005
	14 30	0016	8.9	11.9		170	7.90	14	0.040	0.300	0.080	0.017
	14 30	0026	8.5	11.3		170	7.80	13	0.050	0.300	0.080	0.006
73/07/23	12 45	0000	26.2	8.4	100	162	7.50	21	0.070	1.000	0.050	0.011
	12 45	0005	25.9			160						
	12 45	0010	25.7			160						
	12 45	0015	25.1	7.2		154	6.80	20	0.060	0.400	0.050	0.009
	12 45	0020	22.3	2.8		140	6.40	21	0.100	0.300	0.050	0.010
	12 45	0025	15.1	0.1		130	6.40	27	0.250	0.400	0.050	0.035
	12 45	0030	13.9	0.5		137	6.50	28	0.390	1.100	0.040	0.036
73/10/03	10 10	0000	19.2		90	175	6.50	21	0.040	0.600	0.030	0.007
	10 10	0005	18.9	8.3		175	6.70	22	0.030	0.400	0.020	0.006
	10 10	0015	18.9	8.0		175	6.80	23	0.030	0.300	0.020	0.005
	10 10	0025	18.9	5.8		175	6.60	23	0.090	0.700	0.020	0.006

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	14 30	0000	0.017	26.1
	14 30	0006	0.014	
	14 30	0016	0.017	
	14 30	0026	0.013	
73/07/23	12 45	0000	0.019	9.2
	12 45	0015	0.022	
	12 45	0020	0.025	
	12 45	0025	0.045	
	12 45	0030	0.156	
73/10/03	10 10	0000	0.023	7.0
	10 10	0005	0.020	
	10 10	0015	0.021	
	10 10	0025	0.052	

K VALUE KNOWN TO BE
LESS THAN INDICATED

29

STORET RETRIEVAL DATE 76/06/04

341505
40 58 41.0 074 36 50.0 3
LAKE HOPATCONG
34027 NEW JERSEY

013392

11EPALES 2111202
0017 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	15 00	0000	12.7		72	148	6.90	12	0.040	0.300	0.120	0.005
	15 00	0006	11.9			140	7.30	13	0.030	0.200K	0.120	0.004
	15 00	0013	11.1			140	7.90	13	0.040	0.200K	0.120	0.005
73/07/23	13 30	0000	25.6		70	136	7.20	25	0.080	0.600	0.060	0.008
	13 30	0005	25.4	7.2		137	7.00	25	0.070	0.500	0.060	0.007
	13 30	0010	25.3	6.8		137	6.50	26	0.070	0.500	0.050	0.010
73/10/03	10 40	0000	18.9		75	153	6.90	36	0.040	0.700	0.020	0.004
	10 40	0005	18.8	8.0		154	6.80	28	0.030	0.600	0.020	0.005
	10 40	0012	18.7	6.8		185	6.70	30	0.060	0.800	0.020	0.007

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	15 00	0000	0.013	12.6
	15 00	0006	0.014	
	15 00	0013	0.014	
73/07/23	13 30	0000	0.026	13.2
	13 30	0005	0.029	
	13 30	0010	0.030	
73/10/03	10 40	0000	0.029	13.2
	10 40	0005	0.033	
	10 40	0012	0.068	

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

341701
40 54 27.0 074 41 38.0 3
LAKE MUSCONETCONG
34037 NEW JERSEY
020392

11EPALES 2111202
0005 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	10 50	0000	13.5	10.8	60	195	7.90	28	0.050	0.600	0.150	0.012
73/07/23	15 40	0000	27.3		72	196	8.50	34	0.070	0.800	0.050	0.009
	15 40	0003	26.6	9.8		195	7.60	33	0.100	1.200	0.060	0.035
73/10/01	16 30	0000	19.3	9.0	60L	350	6.90	13	0.060	0.800	0.030	0.006

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	10 50	0000	0.027	9.4
73/07/23	15 40	0000	0.044	20.1
	15 40	0003	0.118	
73/10/01	16 30	0000	0.028	3.7

L ACTUAL VALUE IS KNOWN TO BE
GREATER THAN VALUE GIVEN

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/06/04

3415A1
40 55 00.0 074 39 59.0 4
UNNAMED STREAM
34 7.5 STANHOPE
O/LAKE HOPATCONG 020392
2NDRY RD BRG NEAR USGS GAGE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	09 35		0.030	1.050	0.280	0.006	0.025
73/08/18	10 00		0.016	0.790	0.130	0.009	0.035
73/09/22	10 15		0.024	1.050	0.080	0.007	0.025
73/10/27	11 00		0.231	0.400	0.023	0.009	0.015
73/11/10	11 30		0.054	0.500	0.029		0.020
73/12/08	12 00		0.116	0.400	0.020	0.005K	0.015
74/01/05	11 00		0.192	0.600	0.022	0.005K	0.015
74/02/02	10 30		0.260	0.300	0.010	0.005K	0.015
74/02/24	10 30		0.288	0.300	0.010	0.005K	0.020
74/03/31	10 05		0.200	2.400	0.065	0.005	0.015
74/04/28			0.072	0.400	0.015	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

341581
40 58 12.0 074 35 56.0 4

34 7.5 DOVER
I/LAKE HOPATCONG 013392
ST HWY 15 BRDG S END OF LAKE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	09 15		0.016	0.990	0.252	0.006	0.025
73/08/18	09 30		0.010K	0.600	0.126	0.005K	0.030
73/09/22	09 15		0.042	5.300	1.180	0.008	0.040
73/10/27	10 00		0.042	0.500	0.140	0.009	0.025
73/11/10	10 30		0.060	0.350	0.052		0.005K
73/12/08	12 30		0.052	1.000	0.028	0.005K	0.010
74/01/05	09 30		0.112	0.400	0.028	0.005K	0.005
74/02/02	09 30		0.108	0.500	0.025	0.005K	0.010
74/02/24	09 30		0.152	0.300	0.022	0.005K	0.015
74/03/31	09 30		0.080	1.100	0.040	0.005K	0.010
74/04/28	10 00		0.024	0.200	0.015	0.005K	0.005K

K VALUE KNOWN TO BE
LESS THAN INDICATED

34

STORET RETRIEVAL DATE 76/06/04

341521 AS341521 P000450
40 56 00.0 074 38 30.0 4
MT ARLINGTON GARDEN APTS(MT ARL)
34 7.5 STANHOPE
D/LAKE HOPATCONG 020392
LAKE HOPATCONG
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/06/26	12 00		12.400	4.900	0.052	5.880	5.900	0.020	0.020
73/07/26			8.900	0.160	0.160	5.900	6.000	0.020	0.020
73/09/28	10 00		13.000	0.540	0.540	7.450	7.700	0.020	0.020
73/10/25	13 30		9.700	0.850	0.016	6.950	6.950	0.020	0.020
73/12/27	09 00		1.680	15.500	6.300	4.300	4.800	0.020	0.020
74/04/26	13 00		11.000	4.800	4.800	5.000	7.700	0.020	0.020
74/05/23	13 00		9.900	11.000	2.600	7.800	8.800	0.020	0.020
74/06/27	12 30		4.810	22.000	9.500	4.300	4.800	0.022	0.022
74/07/25	09 30		5.200	19.000	10.000	4.700	5.400	0.018	0.021
74/08/26	11 45		4.000	17.000	0.068		5.300	0.020	0.047
74/09/26	11 00		3.200	14.000	10.500	4.250	4.300	0.018	0.020
74/10/24	10 30		5.900	14.000	5.600	4.100	4.600	0.019	0.019

STORET RETRIEVAL DATE 76/06/04

341531 AS341531 P000116
40 55 58.0 074 38 35.0 4
OUR LADYOF LAKE SCHOOL
34 7.5 STANHOPE
O/LAKE HOPATCONG 020392
LAKE HOPATCONG
11EPALES 2141204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/10/03	09 30		11.600	1.800	0.220	1.280	1.350	0.001	0.001
73/10/23	16 00		32.000	22.880		3.800	4.400	0.001	0.001
73/11/23	13 00		16.200	0.100K	0.019	1.175	1.237	0.001	0.001
73/12/19	08 00		39.000	8.700	7.900	3.780	4.700	0.001	0.001
74/01/21	10 45		36.000	6.200	5.750	2.640	2.800	0.001	0.001
74/02/21	08 00		26.400	13.000	8.100	2.580	2.800	0.001	0.001
74/03/26	09 00		19.150	28.000		3.700	4.100	0.001	0.001
74/04/24	12 00		44.000	11.000		3.000	4.900	0.001	0.001
74/05/23	12 15		39.000	23.500		3.800	4.900	0.001	0.001
74/06/26	14 00		12.970	2.800	0.060	1.080	1.350	0.001	0.001
74/07/29	12 20		20.000	1.200	0.025	1.400	1.400	0.001	0.001
74/08/28	08 15		14.000	6.700	0.050K		2.700	0.001	0.001

K VALUE KNOWN TO BE
LESS THAN INDICATED

36

STORET RETRIEVAL DATE 76/06/04

3417A1
40 54 05.0 074 42 20.0 4
MUSCONETCONG RIVER
34 7.5 STANHOPE
O/LAKE MUSCONETONG 020392
US 206 BRDG BTWN STANHOPE & NETCONG
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	10 05		0.032	1.050	0.290	0.008	0.035
73/08/18	10 00		0.010K	0.810	0.093	0.006	0.040
73/09/22	11 45		0.013	0.865	0.280	0.005K	0.025
73/10/27	11 10		0.020	0.750	0.026	0.006	0.025
73/11/10	13 00		0.115	0.500	0.026		0.015
73/12/08	11 20		0.156	0.500	0.012	0.005K	0.020
74/01/05	11 00		0.276	0.500	0.020	0.005K	0.010
74/02/02	10 00		0.380	0.300	0.015	0.005	0.045
74/02/24	11 30		0.312	0.400	0.025	0.005K	0.030
74/03/31	11 00		0.320	1.800	0.052	0.005K	0.012
74/04/28	11 15		0.020	0.500	0.010	0.005K	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/06/04

341781
40 55 00.0 074 39 59.0 4
UNNAMED STREAM
34 7.5 STANHOPE
I/LAKE MUSCONETONG 020392
2NDRY RD BRG NEAR USGS GAGE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/07/21	09 50		0.012	0.970	0.260	0.005K	0.020
73/08/18	10 30		0.016	0.750	0.154	0.005K	0.030
73/09/22	10 15		0.010	0.820	0.090	0.005K	0.025
73/10/27	11 00		0.200	1.850	0.290	0.006	0.010
73/11/10	11 30		0.050	1.350	0.126		0.020
73/12/08	12 00		0.112	1.100	0.024	0.005K	0.015
74/01/05	11 00		0.184	0.300	0.016	0.005K	0.010
74/02/02	10 00		0.240	0.200	0.010	0.005K	0.015
74/02/24	10 45		0.288	0.300	0.010	0.005K	0.020
74/03/31	10 00		0.208	1.200	0.050	0.010	0.020
74/04/28	10 30		0.036	0.400	0.010	0.005K	0.017

K VALUE KNOWN TO BE
LESS THAN INDICATED

3pp

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1973

STATE OF NEW JERSEY

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3402	BUDD LAKE	0.082	0.205	474.000	48.500	7.400	0.012
3403	GREENWOOD LAKE	0.021	0.100	414.250	11.920	14.800	0.007
3406	ORADELL RESERVOIR	0.055	0.990	462.500	22.267	13.600	0.008
3409	PINECLIFF LAKE	0.070	0.175	465.500	38.960	11.000	0.011
3410	POMPTON LAKES	0.071	0.795	463.167	23.033	11.800	0.029
3412	DUHERNAL LAKE	0.082	1.420	466.667	6.800	8.600	0.010
3413	FARRINGTON LAKE	0.055	0.770	462.000	8.283	14.460	0.012
3415	LAKE HOPATCONG	0.022	0.120	416.333	13.627	14.900	0.007
3417	LAKE MUSCONETCONG	0.036	0.140	436.000	11.067	6.000	0.010
3419	PAULINS KILL LAKE	0.133	0.950	460.500	7.017	9.000	0.065
3420	SPRUCE RUN RESERVOIR	0.020	0.470	428.667	15.333	15.000	0.007
3422	UNION LAKE	0.063	1.150	463.200	22.080	12.800	0.018
3423	WANAQUE RESERVOIR	0.014	0.120	355.333	7.111	14.800	0.005

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3402	BUDD LAKE	12 (1)	58 (7)	0 (0)	0 (0)	92 (11)	29 (3)	191
3403	GREENWOOD LAKE	83 (10)	100 (12)	92 (11)	58 (7)	21 (2)	83 (9)	437
3406	ORADELL RESERVOIR	54 (6)	17 (2)	42 (5)	25 (3)	42 (5)	67 (8)	247
3409	PINECLIFF LAKE	33 (4)	67 (8)	17 (2)	8 (1)	67 (8)	42 (5)	234
3410	POMPTON LAKES	25 (3)	33 (4)	33 (4)	17 (2)	58 (7)	8 (1)	174
3412	DUHERNAL LAKE	12 (1)	0 (0)	8 (1)	100 (12)	83 (10)	58 (7)	261
3413	FARRINGTON LAKE	54 (6)	42 (5)	50 (6)	75 (9)	33 (4)	29 (3)	283
3415	LAKE HOPATCONG	75 (9)	87 (10)	83 (10)	50 (6)	8 (1)	83 (9)	386
3417	LAKE MUSCONETCONG	67 (8)	75 (9)	67 (8)	67 (8)	100 (12)	50 (6)	426
3419	PAULINS KILL LAKE	0 (0)	25 (3)	58 (7)	92 (11)	75 (9)	0 (0)	250
3420	SPRUCE RUN RESERVOIR	92 (11)	50 (6)	75 (9)	42 (5)	0 (0)	83 (9)	342
3422	UNION LAKE	42 (5)	8 (1)	25 (3)	33 (4)	50 (6)	17 (2)	175
3423	WANAQUE RESERVOIR	100 (12)	87 (10)	100 (12)	83 (10)	21 (2)	100 (12)	491

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3423	WANAQUE RESERVOIR	491
2	3403	GREENWOOD LAKE	437
3	3417	LAKE MUSCONETCONG	426
4	3415	LAKE HOPATCONG	386
5	3420	SPRUCE RUN RESERVOIR	342
6	3413	FARRINGTON LAKE	283
7	3412	DUHERNAL LAKE	261
8	3419	PAULINS KILL LAKE	250
9	3406	ORADELL RESERVOIR	247
10	3409	PINECLIFF LAKE	234
11	3402	BUDD LAKE	191
12	3422	UNION LAKE	175
13	3410	POMPTON LAKES	174